PURDUE ENGINEERING

ENVIRONMENTAL AND ECOLOGICAL ENGINEERING

EEE Research Seminar
DATE: Tuesday, April 3, 2018
TIME: 10:30 A.M.
LOCATION: Fu Room POTR 234

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Enhanced microbial growth and metabolism in presence of suspended mineral particulates and proposed mechanisms

Abstract

Microbial interactions with fine inorganic particles in the subsurface and other heterogeneous environmental systems can positively or negatively affect microbial growth and metabolism. We systematically examined mechanisms to explain the observed microbial growth enhancement in batch cultures of *Acidovorax* sp. 2AN caused by particles of hydrous ferric oxide (HFO) and Min-U-Sil 5, a high-purity silica. These micron- and submicron-sized particles stimulated growth and substrate utilization of strain 2AN in both oxic and anoxic cultures, although inhibition was initially observed with HFO. When grown anaerobically on acetate and nitrate in the presence of 1 mM HFO, final protein concentrations were 24.6% higher with HFO, compared to cultures lacking HFO, although 2AN is not an Fe(III)-reducer. Compared to non-amended controls, anaerobic growth in the presence of Min-U-Sil 5 was more rapid and 16% more protein was produced at the end of the experiment. Under aerobic conditions, protein concentrations were 15% and 13% higher in cultures with Min-U-Sil 5 and HFO, respectively, than in controls lacking particulates. Strain 2AN also formed more pili when grown with Min-U-Sil 5 than in its absence. Growth enhancement did not result from particulates serving as an electron acceptor, nutrient source, or pH buffer. Enhanced growth and metabolism was also not due to surface-charge-associated changes in proton motive force and increased ATP generation. The stimulatory effect may be the result of greater microbial access to sorbed substrates or a more generalized effect on gene expression, as evidenced by increased pili formation during particulate-cell association.

Bio

Flynn Picardal is a Professor in the School of Public and Environmental Affairs at Indiana University in Bloomington, Indiana. Dr. Picardal received a B.A. in Bology from the University of Rochester, a M.Eng. in Environmental Engineering from Stevens Institute of Technology, and Ph.D. in Civil (Environmental) Engineering from the University of Arizona. Following a postdoctoral stay at the EAWAG in Zürich, he joined Indiana University in 1993. As a Fulbright Senior Scholar during 2001-2002, he spent a sabbatical year at the Max Planck Institute for Marine Microbiology in Bremen, Germany. He has also spent two, year-long sabbaticals at the Technische Universität-Berlin. He is an environmental microbiologist and biogeochemist who studies the direct and indirect effects of microbial activity on the cycling of elements and the biodegradation of organic and inorganic chemicals in aquatic systems, soils, and sedimentary systems. His research crosses the intersection of environmental science and engineering and focuses on interdisciplinary aspects of environmental microbiology, bioremediation, and biogeochemistry.